"I hereby acknowledge that the scope and quality of this thesis is qualified for the award of the Bachelor of Electrical Engineering (Electronics)"

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Date : 23th November 2009

PID DUAL SPEED MOTOR CONTROLLER FOR MOBILE ROBOR APPLICATION

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ABSTRACT

Robot becomes widely used in industrial due to their characteristics. Robot able to work in 24 hours continuously without feeling tired unlike human that confine to certain time. The cost to setup the robot nowadays becomes more affordable and their long term prospect is bright judging from their capacity to perform. But in reality, there is no robot able to function perfectly and still making error. A better controller needed here, to allow the robot performs efficiently and make less error. This project try to implement a PID controller on mobile robot to see whether the robot perform efficiently. This mobile robot has encoder for each two wheel to give feedback pulse width modulation (PWM) at PIC controller to do PID algorithm. When PID have implemented, the robot will be able to moving along the track straight and smoothly.

ABSTRAK

Robot semakin digunakan secara meluas dalam industri kerana ciri-ciri robot yang baik untuk keadaan di dalam kilang. Robot boleh melakukan kerja 24 jam secara berterusan tanpa henti di mana robot tidak pernah merasa letih tidak seperti manusia yang mempunyai had masa akibat keletihan. Kos untuk memasang robot menjadi semakin murah dan prospek masa panjang yang baik di mana robot dapat melakukan kerja dengan baik dan memuaskan. Tetapi secara realitinya, robot tidak semestinya dapat menjalankan kerja dengan sempurna dan besar kemungkinan melakukan ralat. Di sini suatu sistem di perkenalkan iaitu sistem kawalan yang dapat membantu robot melakukan kerja dengan lancer dan kurang melakukan ralat. Projek ini cuba mengaplikasikan pengunaan kawalan PID ke atas robot untuk menentukan samaada robot dapat berfungsi dengan baik atau tidak. Robot ini menpunyai pengekod bagi setiap satu roda yang akan memberi tindak balas *pulse width modulation (PWM)* kepada PIC untuk melakukan PID algoritma. Apabila pengaplikasian kawalan PID dilakukan, robot ini dilihat dapat bergerak lurus dan mengikutinya dengan lancar.

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LIST OF ABBREVIATIONS

Kp	-	Proportional Gains
Ki	-	Proportional Integral
Kd	-	Proportional Derivative
P	-	Proportional
PI	-	Proportional Integral
PID	-	Proportional Integral Derivative
T_s	-	Settling Time
T_p	-	Peak Time
T_r	-	Rise Time
PV	-	Present Value
SP	-	Set Point

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CHAPTER 1

INTRODUCTION

1.1 Background

This project is to design and to control a mobile wheel robot applications when desired of speed motor is restored and maintained during any disturbances to a set value. In this project, robot needed to have precise control of its speed and position. By using PID (Proportional, Integral, and Differential) as control loop to control the speed of the motors. In order to give the robot all of these features, sub-processor was devoted to the low-level control of the two primary motors. This system is implementing by using a Microchip PIC. This processor was housed on the same board as the motor driver which took control signals from this controller and used them to actually drive the motors. The sub-processor monitored the motors, and applied an appropriate pulse width modulated (PWM) signals to allow them to reach their goal. This controller also had the ability to communicate with the primary controller to receive speed commands as well as report accomplished speed and distance traveled back to the commanding processor. The speed of the motors is manipulated by altering the duty cycle of a PWM signal generated by the processor. The duty cycle of this signal is known as the control value. In this way, the control value is continuously updated based on the response of the motors. This ensured that

the motors are moving at the desired speed despite drag, obstacles, or other unexpected track conditions.

The main contribution is the algorithm of PID controller. A proportional-integral-derivative controller (PID controller) is a generic control loop feedback mechanism widely used in industrial control systems. The PID controller calculation involves three separate parameters; the Proportional, the Integral and Derivative values. The Proportional value determines the reaction to the current error, the Integral value determines the reaction based on the sum of recent errors, and the Derivative value determines the reaction based on the rate at which the error has been changing. The PID controller compares a measured value from a process with a reference set point value. The difference (error) is then used to calculate a new value for a manipulate table input to the process that brings the process measured value back to its desired set point. Unlike simpler control algorithms, the PID controller can adjust process outputs based on the history and rate of change of the error signal, which gives more accurate and stable control. PID controllers do not require advanced mathematics to design and can be easily adjusted (tune) to the desired application [1].

The purpose to design this project is to overcome the problem in mobile robot application like control speed to set point what we have set their speed in controller. This is because when mobile robot has not set their speed it will moving crooked and when it moving out ranges of their speed it will make crashed and damage the robot. So, we use PID controller to overcome this problem.

1.2 Problem Statement

Nowadays many controller are use to control all of many machine and robot. In this machine and robot PWM of their speed is important part to control. But to control all of this part are needed some controller to set their speed to the desire speed. In this project speed of dual wheel robot mobile application will be test and

output from dc motor transmit to encoder and it will give feedback to controller. If no feedback from controller, dual wheel of mobile robot application easily to go out from the line without implementation of control methodology in it system. Thus, control methodology such as PID controller is used to limit the maximum overshoot as well as for control the speed to desire speed. Therefore the main issue on implementing PID control system is on how to design an algorithm and correctly functioning as true PID behavior to control speed in dual wheel dc motor. Then in PID algorithm must focus on issues in error calculation and integral Windup for complete the setting to control the speed.

1.3 Objectives of the Project

The objectives of this project are:

i. Developed mobile robot model for this project.
ii. Developed firmware for mobile robot to control speed.
iii. Implemented a closed-loop PID controller to control speed of two DC motors in mobile robot wheel application.

1.4 Project Scope

The scopes of this project are:

i. PID Algorithm.
ii. Implement the PID Algorithm in PIC controller.
iii. This project is focused on designing mobile robot to controlling speed at dc motor dual their wheel by using subroutine of PID algorithm such calculation

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